ABSTRACT

The present invention relates to devices and methods of modifying the neuronal activity of a neural system comprising neurons, comprising, one or more of the following steps, measuring the neuronal activity of a neural system; and applying an oriented electric field to said neural system effective to modify the neuronal activity of the neural system, wherein the magnitude and polarity of said applied electric field is changed in response to the measured neuronal activity. The present invention also relates to devices and methods for treating brain disorders, such as epilepsy and Parkinson's disease, comprising, one or more of the following steps, applying a sub-threshold and oriented electric field *in situ* to the brain of a patient having such a disorder in an amount effective to reduce the abnormal activity of the brain, wherein the electric field is applied through field electrodes in contact with the brain. The present invention also relates to methods and devices for restoring or repairing a brain function, such as sensation (e.g., taste, or smell), somatic activity, auditory activity, visual activity, or motor activity. It can also be used for testing drugs, pharmacological agents, and other modulators of neuronal function.